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THE EFFECT OF POST-ARMISTICE CONDITIONS ON MATHEMATICAL COURSES AND METHODS.

By Harry English.

Events are happening so rapidly that one fancies he is looking at a quick-moving kaliedoscope of topsy-turvey happenings colored by the ever-changing play of varied human emotions and interests throughout the world.

At the time the heading on the program was suggested it seemed that there was a reasonably fair chance that conditions as then existent would crystallize rapidly and become stabilized to such an extent as to affect vitally and basically our theory and administration of education. In many ways this seemed to be necessary and desirable; in other ways, most undemocratic and revolutionary.

I had prepared a more or less satisfactory summation of these conditions, and had attempted to deduce some possible conclusions as to their immediate effect and their more remote bearing on our courses and methods of teaching. I had wandered through the maze of offices in Washington where trained investigators were trying to solve the many problems connected with education of all kinds as affected by war conditions,—when the armistice was signed. At once the vital efforts connected with the present draft ceased; the camps of drafted soldiers began to dissolve; the college students' training camps to disintegrate; the war workers to "homeward wend their weary way"; the trained specialists to "fold their tents like the Arab and as silently steal away" and "leave the world to darkness and to me." I had a useless paper on a subject which might have been of interest yesterday, but which, to-day so far as life is concerned, is in a class with similar curiosities found on rolls of papyrus long buried with the Egyptian dead.

Under the circumstances, I most gladly welcomed a suggestion from our President, Dr. Hawkes, to direct my remarks along the lines of the effect of post-armistice conditions on our courses and methods. In the chaos into which I was plunged, I felt as competent to speak on one subject as another, so I made a palimpsest of my original paper, and sailed madly into an uncharted sea, with but a few hours at my disposal for preparation and practically no data at my disposal. I have never posed as a prophet so the rôle is a new one. It is to be noted however that both England and France long ago began a comprehensive study of conditions of all kinds—industrial, commercial, financial, economic, educational—looking towards a complete readjustment wherever made necessary or desirable because of the war. They are about to set this machinery in motion.

As yet our own country has done nothing as a country, though some individual agencies are at work. I have a feeling that something national should have been done some time ago. At present we are drifting especially as to educational reconstruction. One or two states have given the matter some attention, but it is a significant fact that labor is about to appoint general committees, one of which is to make sweeping, comprehensive suggestions as to a plan of education applicable to the entire country, and in this they are to have expert help.

It is a pity that the war educational agencies did not carry on. It is almost criminal that regular educational associations and organizations do not immediately bestir themselves.

Let me very briefly allude to factors during the past year or two which have changed markedly the attitude and receptivity of our people in some matters.

A. BEFORE OUR DECLARATION OF WAR.

I. The awakening of the various peoples within the confines of our own country to the true meaning of loyalty to our own country, and the creation of a real national sentiment and of a real American people with national ideals, unity of purpose and will to accomplish.

II. The creation of unified agencies on a vast scale to aid the stricken peoples of invaded Europe, accompanied by a real personal interest on the part of millions of our own people in the people helped as real flesh and blood persons and not as abstract objects of charity.

III. The assertion of a national conscience akin to that of an individual conscience in dealing with others.

IV. The implanting in the heart of every American boy and girl, and man and woman, of the absolute dependence of the government upon the individual ability and willingness to do to the utmost in a democratic form of government all things necessary to vindicate and reestablish martyred and despoiled peoples.

Many other conditions naturally suggest themselves.

B. AFTER OUR DECLARATION OF WAR.

I. A prompt and cheerful acquiescence on the part of the people, to the drastic provisions of the first draft—a first necessity to win the war.

II. The equally as prompt and cheerful acquiescence of the people, corporations and other big business entities, to the demands of the government as to the control and taking over of railroads, industrial plants, etc.; the limitations as to: food, coal, duration of the business day, general freedom of action, and in fact anything and everything however dear to the heart of the liberty-loving American people—in order to win the war.

III. The overpowering response to the various Liberty Loans by an ever increasing number of subscribers, with the universal, tremendous, intensified American patriotism shown in the grand rallies held for the first loans, and the stern tenseness and determination of the people to see the last one through in spite of the deadly epidemic which raged.

IV. The habits of thrift and economy formed; the real understanding of economics and economies; the concentrated work of all kinds done by the school girls and boys, the collegians, the men and women of all classes and in all pursuits to see our own Army and Navy through, while still carrying on the charitable work of relief for the increasing millions of dependents in Europe; the intense interest in our own soldier and sailor boys, individually and collectively.

V. The levy of enormous taxes, especially the income tax.

VI. The tremendous increase in our wealth and in the cost of living.

VII. The wonderful attitude of our people as regards the second and last draft law, invading as it did every activity in the country and tending to disorganize every institution, every agency, every business and every home in our country which was founded upon a deadly antagonism to such arbitrary power to which however it yielded for the time being to bring to those people of the world deserving and desiring it, a permanent freedom such as we have heretofore enjoyed.

All of the foregoing leads naturally to a brief consideration of some of the effects of this law upon education and the educational institutions of our country, and has been presented as a background necessary to the proper understanding of the general effect of the lowering of the draft age for the second draft, and as indicating in a most cursory way some of the conditions back into which we were abruptly thrust when the armistice was signed, November 11, 1918. A mere glimpse of the condition will be given.

THE PERIOD DURING WHICH THE SECOND DRAFT WAS EFFECTIVE.

Much literature of a general as well as specific nature with reference to war activities appeared during the summer and early fall of 1918.

Among the authoritative issues has been a series of pamphlets issued by the Bureau of Education entitled "School Life." Seven pamphlets have been issued so far, the first on August 1, 1918; the last so far on November 1, 1918. The articles deal almost exclusively with problems affecting the reconstruction of courses and the work in educational institutions to meet the requirements of war conditions.

Another important work is that discussed in issues of the *American Mathematical Monthly*, September, October, November, 1918. Still another, as yet in the making, that of Professor Young of Dartmouth College.

Whether Congress intended it or not, the result of lowering the draft age to eighteen years was to make every college in its entirety a war camp so far as boys and men were concerned. Had the draft age been set at nineteen or twenty years, roughly speaking about half of each college would have been under the old regime, and half under the new. As it was, to all intents and purposes the Secretary of War became the Director of Education for all male colleges, with a divided authority in co-educational institutions and with no authority except by force of example in female colleges.

To a large extent members of the fourth-year class in all our high schools were similarly affected, and also individuals here and there in the third-year class.

The War Department called to its aid trained specialists and began to formulate plans as to administration and as to setting into motion of intensive composite courses in colleges. Many college professors promptly began to consider the subject matter of courses and methods of presentation.

Special emphasis was laid upon the necessity for intensive work in industrial courses in high schools and a call was made for intensive work in all branches taken by boys of eighteen years or over with the view of having these boys graduate into the college camps every twelve weeks instead of every eighteen weeks.

It was urged at first that care be exercised in selecting properly trained teachers, especially manual training teachers. This proved impossible, as it turned out, because the industries and the draft took away the bulk of the latter class of teachers and left no visible supply upon which to draw.

In fact the teachers shortage problem became a tremendous problem, and a migration of teachers took place in order to find salaries upon which to live. The teachers formed the one great class of war workers whose salaries, authorities were not forced to raise.

The intensive work in colleges necessarily modified the character and the amount of academic training. The effect upon secondary schools seemed merely the elimination of non-essentials if anywhere found, and the lengthening of the recitation periods for those pupils affected. In our own high schools in Washington, which are co-educational, many students, not affected by the draft, both boys and girls, desired to take ad vantage of these courses in order to shorten their time at school; heads of departments prepared suggestions for modified courses which contained all essentials, while improved methods of teaching were put in operation by trained teachers selected from the regular corps. Some classes began at 8:30 A.M. instead of at 9 A.M. It was hoped that habits thus inculcated in these pupils, by force of example would extend throughout the entire school and that we might return to the basis of regular work in vogue some twenty-five years ago for all classes, but which had just been provided as special intensive work for the few. The influenza epidemic closed the schools for a month, but after reopening, allowing time for proper adjustment, redoubled efforts were made to accomplish the work desired. It was hoped that we could get information from the colleges as to their work so that we could get in line if possible to give direct help.

The armistice was signed, and in an inconceivably short time pupils began to withdraw from intensive classes which finally disappeared. The buoyancy and mercurial disposition of youth reasserted themselves in the girl and the boy who for several years had been in the atmosphere of national endeavor doing a woman's and a man's work. The spur and whip of stern necessity had ceased to operate and old habits began to function. It may be that this spirit of itself will be the salvation of the people to enable them to forget speedily the horrors of the present, and that the real helpful effects will emerge later and be shown by real work and real appreciation of what the present and the future really mean. Longfellow, the poet of childhood, may be, after all, a real prophet. The present and future are fraught with danger.

For a time it seemed that the college requirements of last year would be swept away, and that induction into college would be largely governed by a war policy. It was asserted by some, very erroneously, that the junior high school would pass into the discard, by others that national supervision or control of education with the military instruction strongly predominant would ensue; by others that education would be industrialized. It is not believed that such will be the case.

There is a very real fear of a somewhat minor nature in secondary schools, owing to changes in certain secondary courses made practically at the behest of the War Department, especially as regards industrial work, that the colleges may not make due allowance therefor, and may unintentionally work hardship as regards those desiring to enter college, by insisting upon the exact credit values in the subjects which were required by colleges before the taking over of the colleges by the War Department and before the lowering of the draft age so vitally affected secondary schools. I am sure that every effort will be made by both to meet the successive dislocations in the fairest possible spirit.

Especially will this be necessary when we recognize that all over the country, secondary schools and colleges have been almost stripped of teachers because of the draft or other necessary war work, and that a period of real readjustment is necessary.

Whether all of these teachers will return is a problem. There are so many opportunities for personal betterment elsewhere that the temptation to abandon the teaching profession which has small salary recognition is well nigh irresistible. If the teachers do return, however, they will bring back to the classroom a vigor and breadth of view because of actual contact with realities which will do much to secure that so-called practical method of treatment which has been so long and so loudly demanded. I am not sure that we do not have it, and that critics have not taken the trouble to discover it. The habit of criticism may be so firmly fixed as not to be eradicated, no matter what the conditions or the truth may be.

Let us recognize further that there are in our schools and colleges more or less firmly implanted, various organized forms of voluntary work closely related to war activities of a charitable or helpful nature which probably will continue for years to come both at home and abroad, together with all that background of other activities briefly characterized at the beginning of this paper. Pupils and teachers for some years have formed part and still are part of it. The supreme moving cause seems to be suddenly removed. Some of these conditions may disappear along with the intensive work. Some however have crystallized into habits which must be considered in any scheme of readjustment of courses. Some reformers urge that they be made regular courses.

Many of our college boys and boys of college age have been in the midst of most vital realities. If they return to college they will have the attitude of experienced men of the world and this cannot be ignored in classroom teaching. To a certain extent this is true of our girls. Indeed many young children have received the pay of men and women and have mingled with men and women as more or less equals. How will they act when they return to the school room?

On the other hand, an incredible amount of illiteracy has been disclosed in army camps, and certain steps should be taken to eradicate it, especially as vast numbers of such men seem so eager to learn who will shortly return to civil life. Of course I do not mean that these men lacked natural intelligence, for in a great number of cases this was of a high order.

Also we must recognize that a tremendous impetus has been given to all trades and forms of labor, and that distinctive schools with such training in view, or the engrafting of such courses upon courses now established or the introduction of such courses into schools now existing must surely follow in increasing numbers. The direct monetary returns therefrom are very great. It is significant that labor is setting in motion with expert help, a definite comprehensive plan of education.

It is also to be noted that the National Education Association and the Association of College Presidents are back of a bill to create a Department of Education which is to take over the functions of such emergency commissions and educational activities created by Congress, as the President may direct. It is also to have certain specified functions of its own. This seems to be in line with the general tendency towards governmental control of all agencies necessary to win the war.

Whether this same spirit will be as intense, now the armistice has been signed, remains to be seen. There seems to be a tendency now to de-centralization and a reversion generally to pre-war conditions.

How far a determination of courses and methods used, as well as of subjects taught, will be affected by these tendencies is uncertain. Undoubtedly there will be a prolonged struggle if indications mean anything.

So far the considerations have been general, it now seems advisable to come down to particulars.

As to Secondary Schools.

Practically nothing has been done. Action was scarcely begun before it was stopped. In all my interviews with officers both before and after the armistice was signed there seemed to be nothing in sight for secondary schools other than practical applications of trigonometry or plane geometry such as obtaining heights, distances, etc., or working out the elementary problems of navigation. It was urged that surveying instruments be provided and that the boy become automatically familiar with them, that practical things be kept in view, that elementary computations be made quickly and without paper, that the boy with a real liking for mathematics and with a quick alert mind was far more desirable than one with a head full of knowledge, but slow in application.

A man to meet emergencies was the ideal. This of course was evident so far as this war was concerned to ensure real participation by the American army because of the time element; for navigators, aviators, and officers connected with more or less mobile artillery would need such characteristics and much more.

It was a saying that men should be taught to shoot in their bathing suits, *i.e.*, if every material practical device and aid were suddenly swept away, the men with their knowledge of formulæ could calculate distances, trajectories, etc. This surely was the case at Chateau Thierry, and if men ever shot in their bathing suits it was there, for all telephone communication with the retreating front had been destroyed, all observation posts, balloons and aeroplanes to give distances and other information were disappearing. The artillery had to abandon their ready-made methods of firing and had to calculate mainly in the old-fashioned, long-hand way to turn the retreat into a stand and then into an advance. The traditions of the army and of mathematics were maintained and lived up to.

As a result of the war there has come into being a series of war problems which met the test of springing up from one's environment so far as men and boys were concerned, but which were of scarcely any interest to girls, who seemed to be sadly neglected so far as adaptations of mathematics were concerned because of the war. It was left for them to obtain human interest from the mathematical courses as best they could. And yet, even now the war problems have begun to recede and before long may pass into the discard together with problems of a more remote antiquity.

It is quite possible indeed that they will be the antiquities of tomorrow.

In this connection I am reminded that thirty years ago and for years thereafter in our Washington high schools before the springtime became the play time for athletic teams and the rest of the admiring pupils, and before there were so many other outside diversions, pupils learned more trigonometry and surveying in the same time that is now devoted to trigonometry alone. We had the very thing then that the army officers say we should have now.

There were certain problems in surveying, using the compass, the sextant, the level, the transit and the plane table.

The problems were as follows: (*a*) distances between inaccessible objects and heights of accessible and inaccessible objects: (*b*) survey for area and plot; (*c*) reconnoissance of a creek or road by Jacob's staff or compass; (*d*) levelling for profile; (*e*) ploting with plane table.

Parties of about six each would go out into the country and each do the problem assigned. If possible, on the same day instruments would be exchanged; bench marks located; each party would check up another's work, and differences in results explained if possible. It might be that a third party would have to go over the same problem. If the problem were too long for a part of a day then the whole day was taken. There was the utmost enthusiasm. After all problems were done, then came the actual plotting of them in a careful and thorough way.

In those days Washington had a strong algebra course in the eighth grade. Then, as now, geometry was always taught from the reasoning standpoint and hundreds of original exercises worked during each year. Fourth-year pupils easily completed, twenty years ago, the Cornell requirements in advanced algebra which were far in excess of the present ones, and in addition studied conics, covering the straight line and circle exhaustively and the other conics comparatively, each pupil making a table of analogous formulas.

In those days also Cornell University gave admission credit for spherical trigonometry taken under me by boys desiring to do so upon the condition that these boys should pass the examination set by myself. It is being urged now that spherical trigonometry should be taken up by secondary schools coupled with the elements of navigation as an addenda to solid geometry; not very extensive to be sure, but enough for the boy to get the idea preliminary to college work. Is it not evident that basic ideas and principles persist and live?

Again, many years ago emphasis was placed on oral analysis or mental arithmetic, to develop the ability to think quickly and accurately, to compute mentally and to express one's thoughts orally in clear concise language. And this is what the army officers are pleading for now.

It would seem then that the main tendencies in secondary schools at the present time because of the war and the armistice, should, if the expectations of the officers with whom I have talked recently are to be realized, be merely to restore the very conditions which existed years ago and to add thereto some practical applications which had come into vogue some years before our declaration of war. In other words it would seem that those trained in the secondary mathematics long ago or even not so very long ago have stood the test of the crisis brought on by the war fairly well and that our secondary mathematical courses are not in such a bad state nor so barren or useless as our critics would have every one believe. If that which colleges seem to be agreed upon as to courses in navigation is desirable, then secondary schools can help them by placing a course in solid geometry after trigonometry followed by the elements of navigation, provided that colleges do not require that a full half year be devoted exclusively to the solid geometry *per se*.

I am hopeful moreover that high schools and grade schools may so speed up as to gain the two years of advantage which some foreign countries have over us. The time so gained could be used to splendid advantage.

As to Colleges.

This will be considered very briefly.

The issues of the *American Mathematical Monthly* for September, October and November, 1918, have gone deeply into the matter of collegiate mathematics for war service, much of which will doubtless continue to function.

Because of the certainty of a great navy and a great merchant marine, it seems to be the consensus of opinion that a course in navigation should be provided in all colleges, again stressing the need for trigonometry which should be taught in all secondary schools with emphasis on the derivation and use of computation formulae. This course in navigation is set out in great detail conforming more or less to that of the Naval Academy and presupposing a course in spherical trigonometry. Other courses are considered, such as naval ordnance and gunnery, nautical astronomy, firing data, graphical solutions, etc., but are not insisted upon.

The November (1918) number of the *American Mathematical Monthly* contains a brief account of the work of the Mathematical Association of America at its meeting held at Dartmouth College, September 5, 6, 7, 1918, where some fifty professors in various colleges, after almost continuous conference, agreed upon the character and contents of: three twelve-week terms for general military students in college; two twelve-week terms in navigation; one eight-weeks course in descriptive geometry. This report went to the government offices in Washington by way of suggestion and it was expected that the government's directions would be issued immediately thereafter. This expectation was not realized, but it is certain that the report must have some effect upon the colleges. So much for specific observations.

In Conclusion.

We are face to face with a general problem of far-reaching significance. There will begin, in the reconstruction of education, a struggle to have all kinds of subjects included in the curriculum and there will be a prolonged fight to industrialize education. To a very limited extent this is right because of the great need to reconstruct the material world, but there is a greater need to reconstruct the morals and ideals of the world and its component parts and to prevent materialism from swallowing up idealism. To this end our mathematical teaching should respond to the touchstone of truth for truth's sake. It must be remembered forever that a deadly efficient practical material empire subverting all else to that of material gain and material expression with no desire to have proper ideals, lost that which stood for a soul and plunged the world into a hideous cataclysm of all but universal ruin.

I believe in practical mathematics, but I believe more in a calm study of the eternal truths of mathematics just at present with the hope that it may stabilize the student in this most critical period in life of his country and himself.

Mathematics has more than justified the position it has always maintained as the corner-stone or keystone upon which the wise direction and successful issues of this war have depended. Turn where you will, you must acknowledge that, either immediately or remotely without mathematics and its applications the war could not have been carried on and won. I do not maintain that it had exclusive jurisdiction; there is glory for all. I do maintain that from every standpoint mathematics has demonstrated conclusively its pre-eminent worth and its uncontrovertible right to be included in the curriculum almost from the very beginning to the end of time.

It is needed now as never before, as a study for its own inherent characteristics to steady the mind and soul afloat on the seething cross currents of Bolshevism which are bound to set in in education government and life. It is one of the few subjects incapable of being distorted because of its inherent nature and is ready at all times to render practical aid to others while acting as a potent factor to keep alive the purity of thought and truth.

FRANKLIN SCHOOL,
WASHINGTON, D. C.
November, 1918.